

Índices de Capacidade do Processo

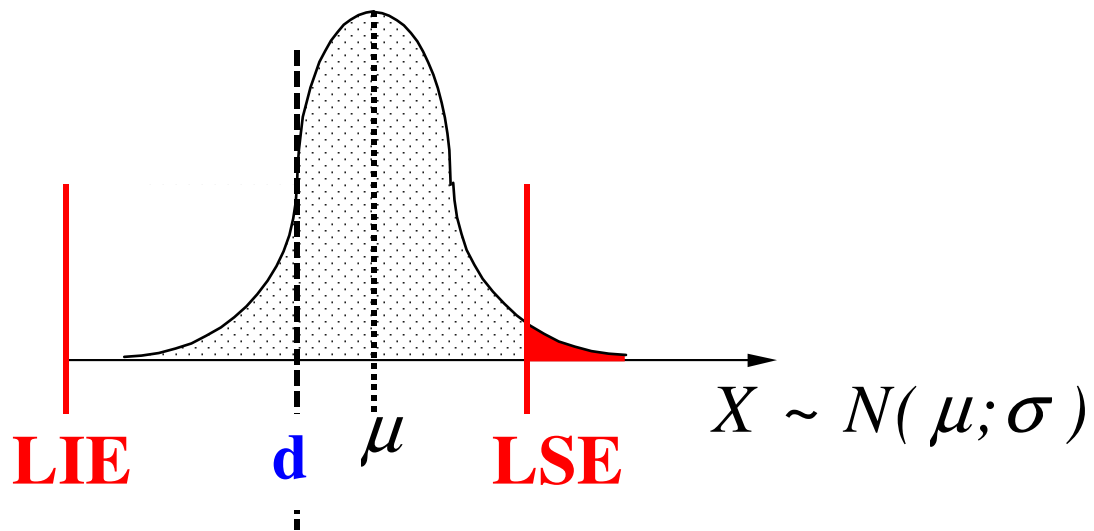
$$C_p = \frac{LSE - LIE}{6\sigma}$$

$$C_{pk} = \text{Min} \left\{ \frac{LSE - \mu}{3\sigma}, \frac{\mu - LIE}{3\sigma} \right\}$$

$$C_{pm} = \frac{LSE - LIE}{6\sqrt{\sigma^2 + (d - \mu)^2}}$$

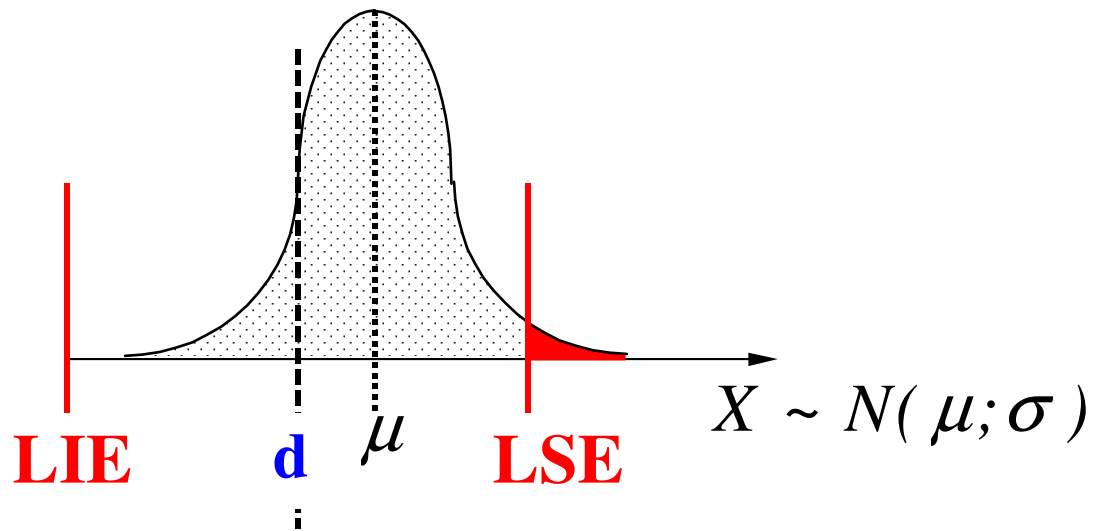
Índices de Capacidade do Processo- Cp

$$C_p = \frac{LSE - LIE}{6\sigma}$$



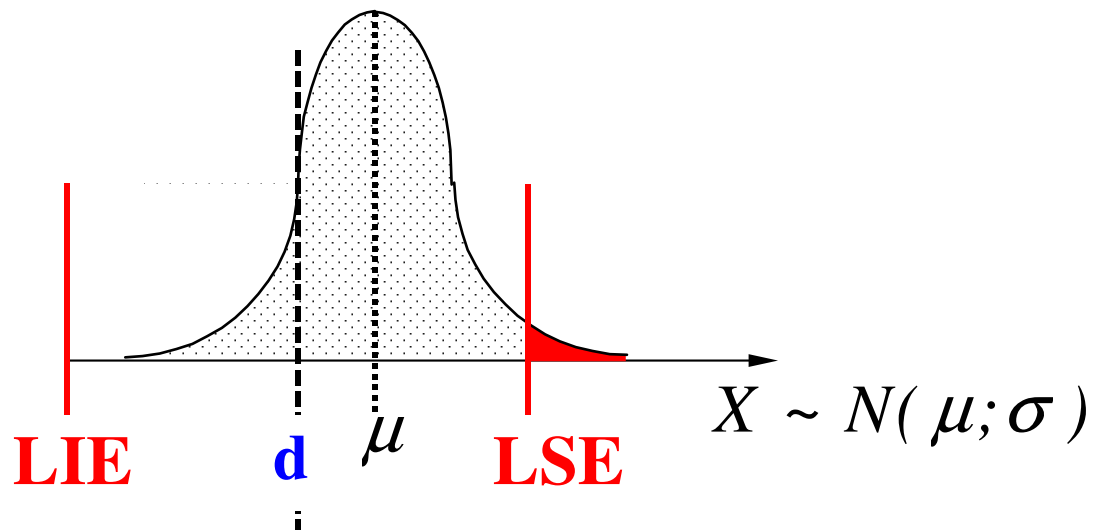
Índices de Capacidade do Processo- Cpk

$$Cpk = \text{Min} \left\{ \frac{LSE - \mu}{3\sigma}, \frac{\mu - LIE}{3\sigma} \right\}$$



Índices de Capacidade do Processo- Cpm

$$C_{pm} = \frac{LSE - LIE}{6\sqrt{\sigma^2 + (d - \mu)^2}}$$



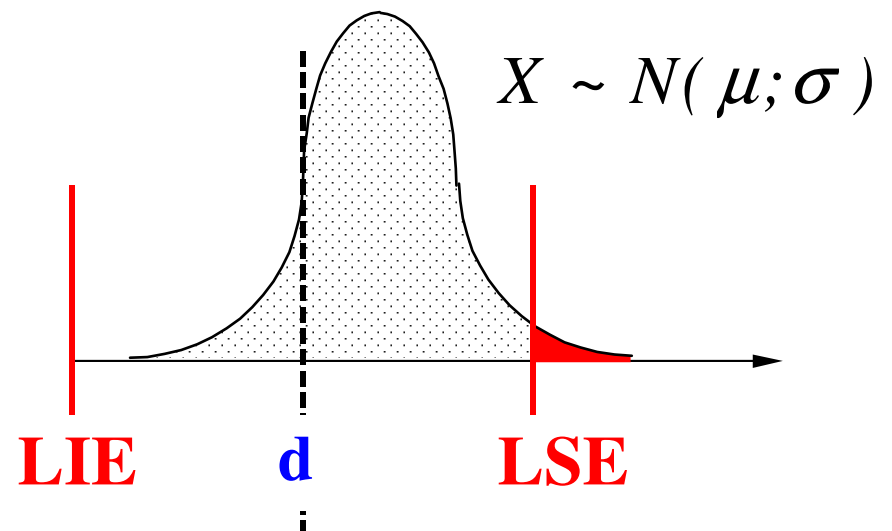
Índices de Capacidade do Processo- Cp

Tabela 2: Valores de Cp para

LIE=2 e LSE=8

$$Cp = \frac{LSE - LIE}{6\sigma}$$

Caso	$(\mu; \sigma)$	Cp
(a)	(5;1)	1
(b)	(6;1)	1
(c)	(7;1)	1
(d)	(8;1)	1
(e)	(9;1)	1
(f)	(10;1)	1
(g)	(7;0,5)	2
(h)	(6;0,5)	2



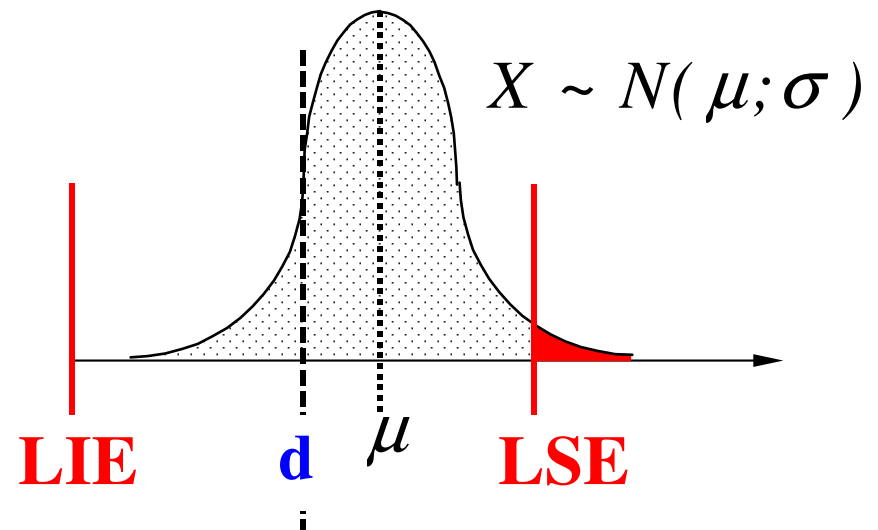
Índices de Capacidade do Processo- Cpk

Tabela 2: Valores de Cpk para

LIE=2 e LSE=8

$$Cpk = \text{Min} \left\{ \frac{LSE - \mu}{3\sigma}, \frac{\mu - LIE}{3\sigma} \right\}$$

Caso	$(\mu; \sigma)$	Cpk
(a)	(5;1)	1
(b)	(6;1)	2/3=0,667
(c)	(7;1)	1/3=0,333
(d)	(8;1)	0
(e)	(9;1)	-1/3=-0,333
(f)	(10;1)	-2/3=-0,667
(g)	(7;0,5)	2/3=0,667
(h)	(6;0,5)	4/3=1,333



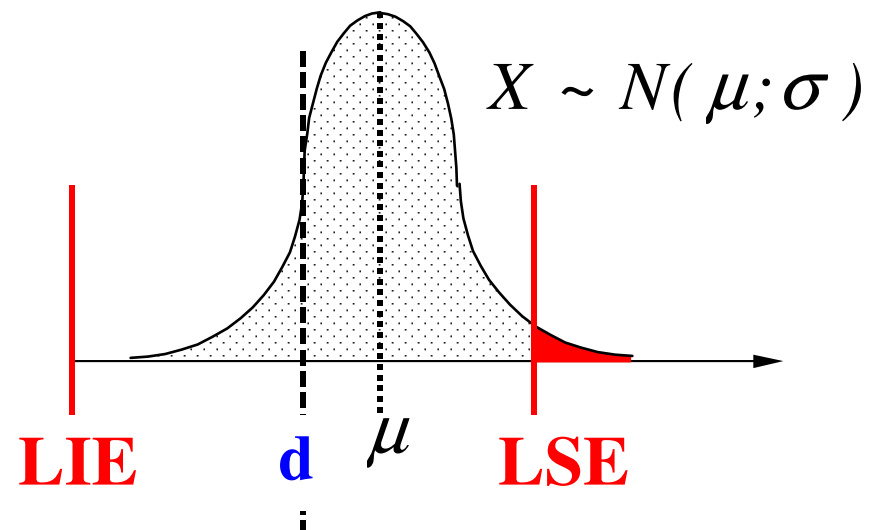
Índices de Capacidade do Processo- Cpm

Tabela 2: Valores de Cpk para

LIE=2 e LSE=8

$$C_{pm} = \frac{LSE - LIE}{6\sqrt{\sigma^2 + (d - \mu)^2}}$$

Caso	$(\mu; \sigma)$	Cpm
(a)	(5;1)	1
(b)	(6;1)	$1/\sqrt{1+1} = 0,707$
(c)	(7;1)	$1/\sqrt{1+4} = 0,447$
(d)	(8;1)	$1/\sqrt{1+9} = 0,316$
(e)	(9;1)	$1/\sqrt{1+16} = 0,243$
(f)	(10;1)	$1/\sqrt{1+25} = 0,196$
(g)	(7;0,5)	$1/\sqrt{0,25+4} = 0,485$
(h)	(6;0,5)	$1/\sqrt{0,25+1} = 0,894$



Índices de Capacidade do Processo

Caso	$(\mu; \sigma)$	Cp	Cpk	Cpm	PFE
(a)	(5;1)	1	1	1	0,27
(b)	(6;1)	1	0,667	0,707	2,27
(c)	(7;1)	1	0,333	0,447	15,87
(d)	(8;1)	1	0	0,316	50,00
(e)	(9;1)	1	-0,333	0,243	84,13
(f)	(10;1)	1	-0,667	0,196	97,73
(g)	(7;0,5)	2	0,667	0,485	2,27
(h)	(6;0,5)	2	1,333	0,894	0,00

Tabela 2: Valores de Cp, Cpk e Cpm para Diferentes Valores de μ e σ , com LIE=2 e LSE=8

Índices de Capacidade do Processo

Caso	$(\mu; \sigma)$	Cpm	PFE
(a)	(5;1)	1	0,27
(b)	(6;1)	0,707	2,27
(c)	(7;1)	0,447	15,87
(d)	(8;1)	0,316	50,00
(e)	(9;1)	0,243	84,13
(f)	(10;1)	0,196	97,73
(g)	(7;0,5)	0,485	2,27
(h)	(6;0,5)	0,894	0,00

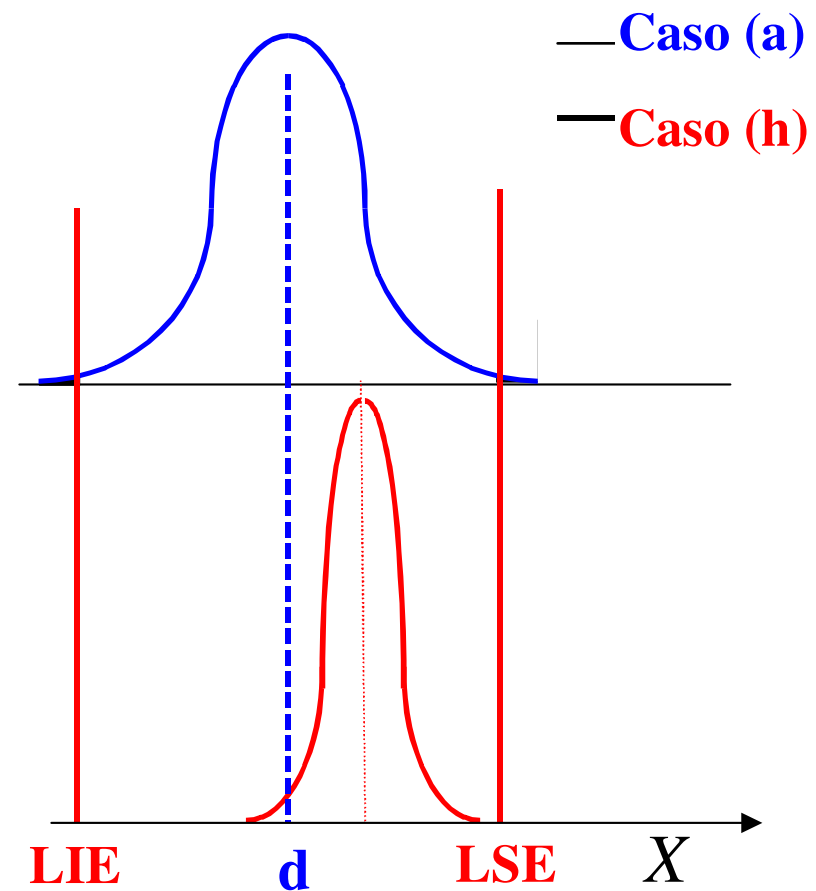


Figura 1: Comparação dos Casos (a) e (h) da Tabela

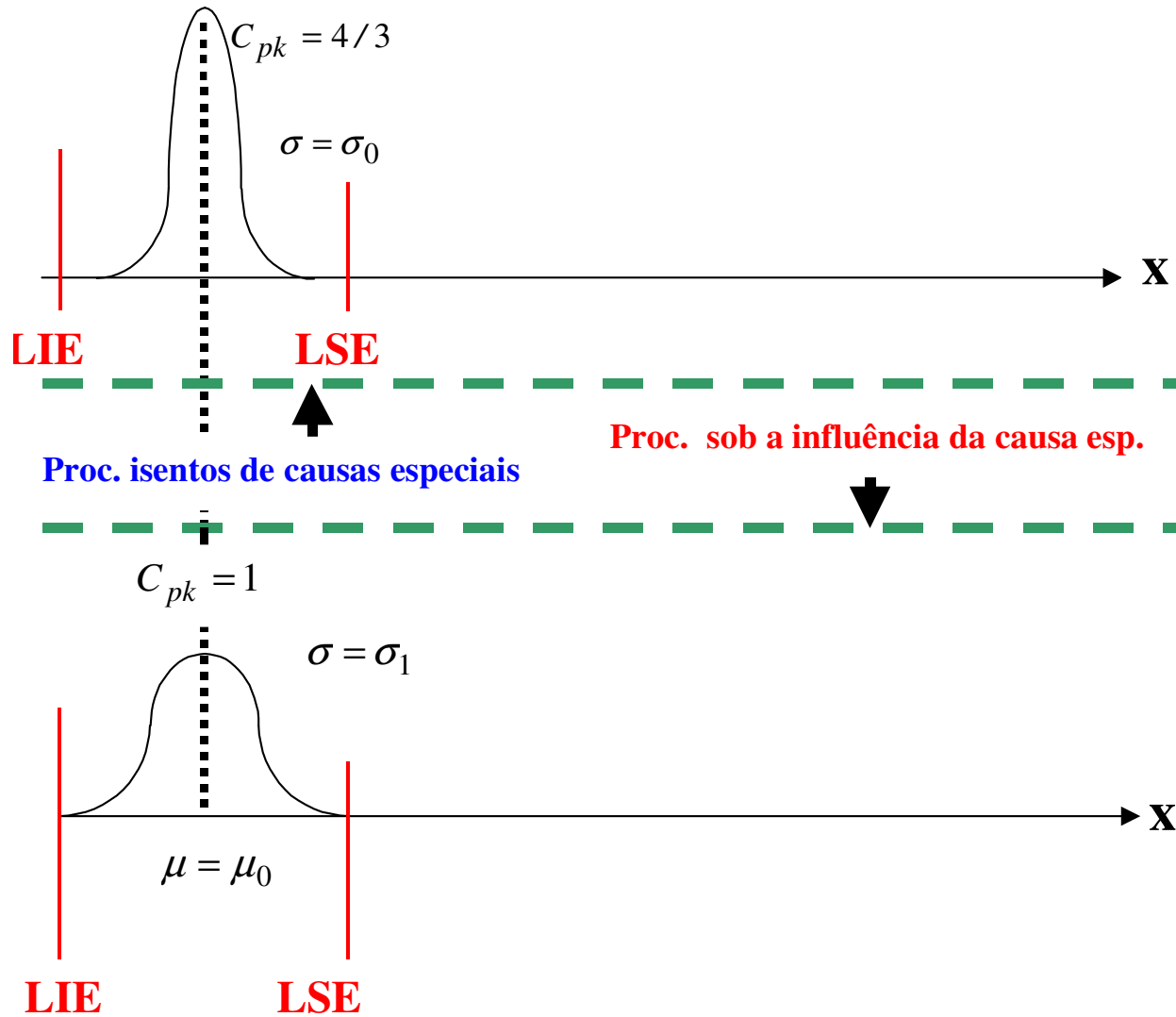
Índices de Capacidade do Processo

Caso	$(\mu; \sigma)$	Cpm	PFE
(a)	(5;1)	1	0,27
(b)	(6;1)	0,707	2,27
(c)	(7;1)	0,447	15,87
(d)	(8;1)	0,316	50,00
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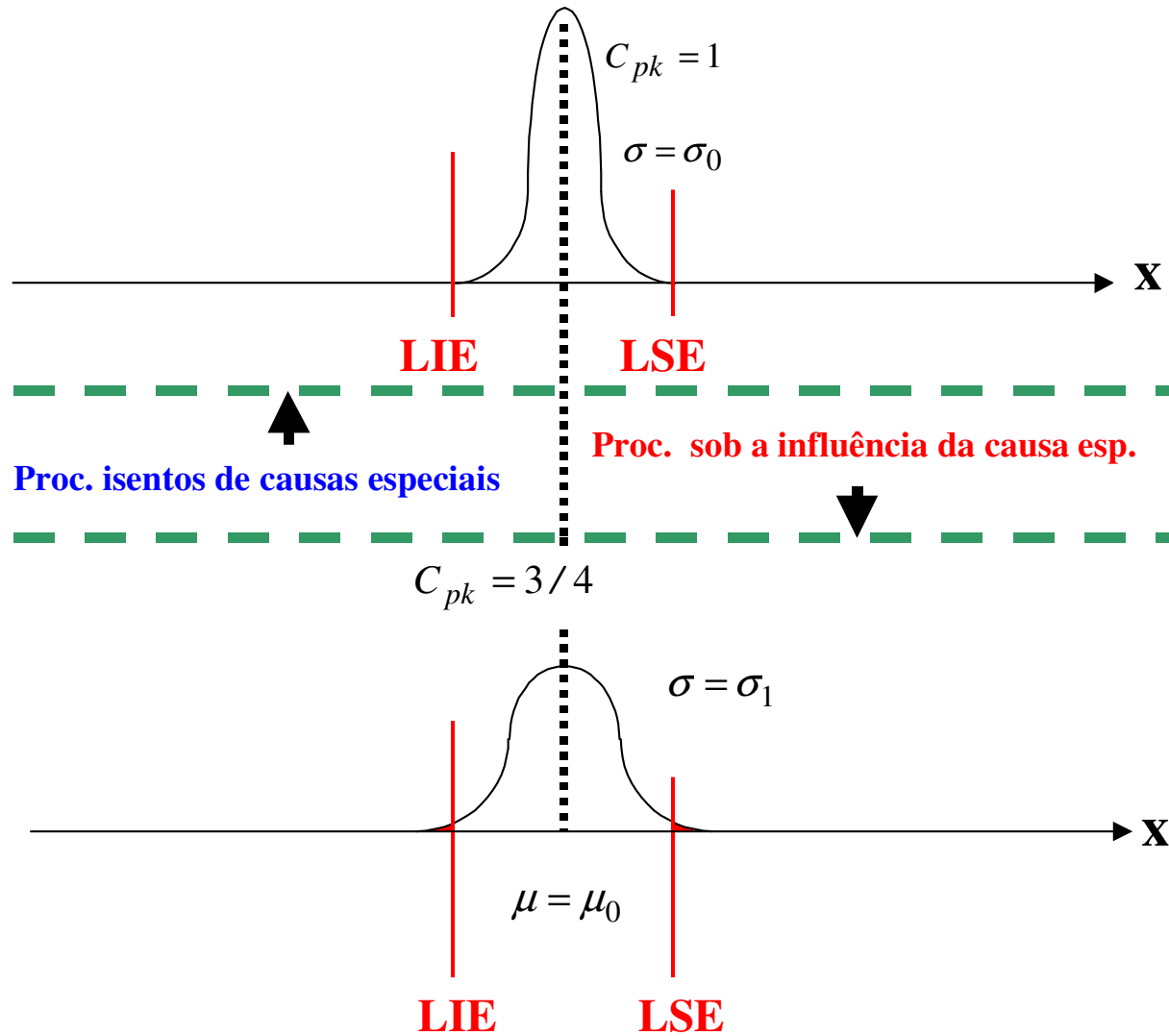
Tabela 3: Classificação do Processo com Respeito à sua Capacidade

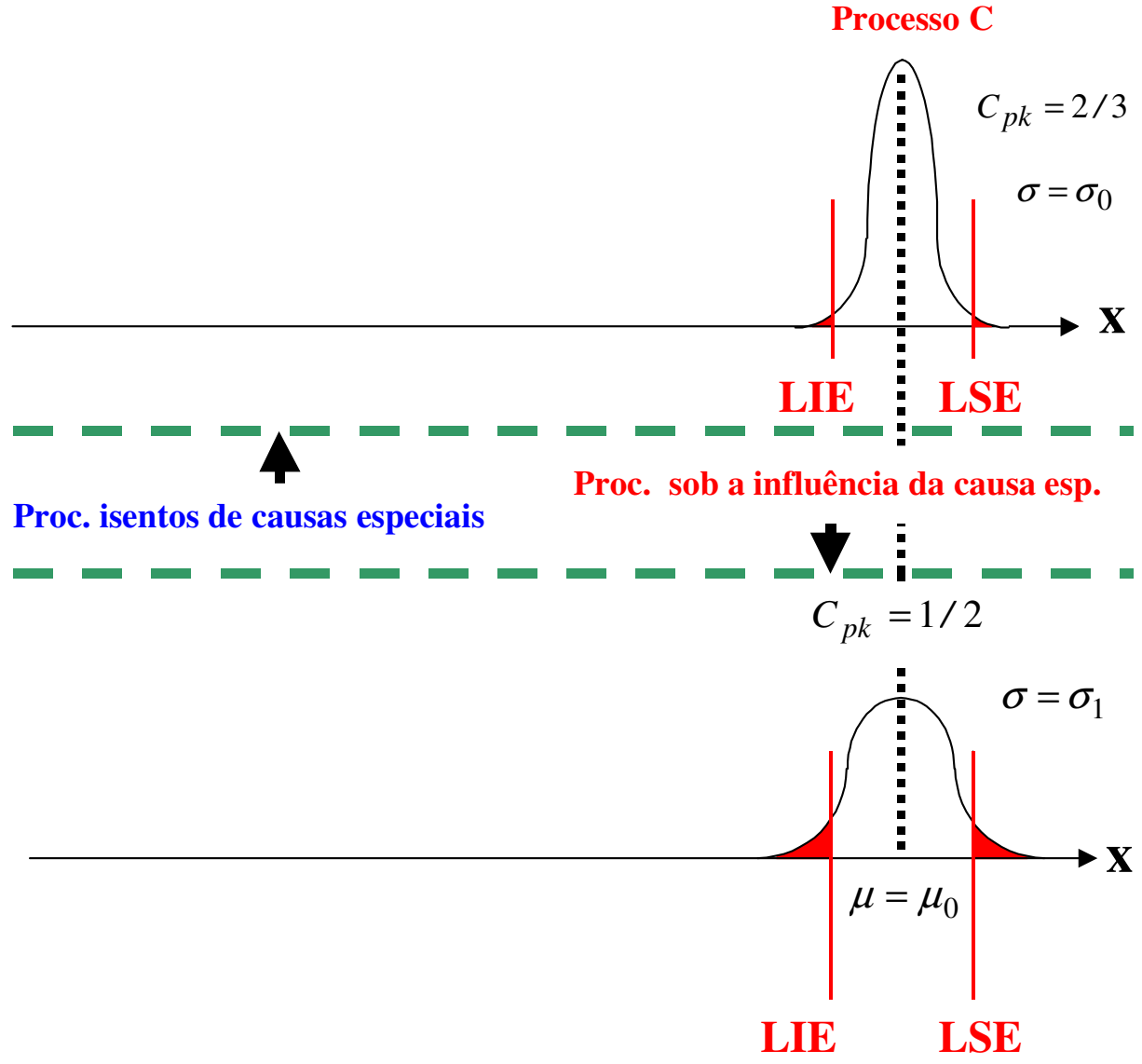
Classificação	Valor de Cpk	Itens fora das especificações (ppm)	
		Especific. bilateral e processo centrado (ICP apropriado: $C_p = C_{pk}$)	Processo não-centrado e/ou especific. unilateral (ICP apropriado: Cpk)
Capaz	maior ou igual a 1,33	70	35
Razoavel- mente Capaz	$1 \leq C_{pk} \leq 1,33$	Entre 70 e 2700	Entre 35 e 1350
Incapaz	menor que 1	mais de 2700	mais de 1350

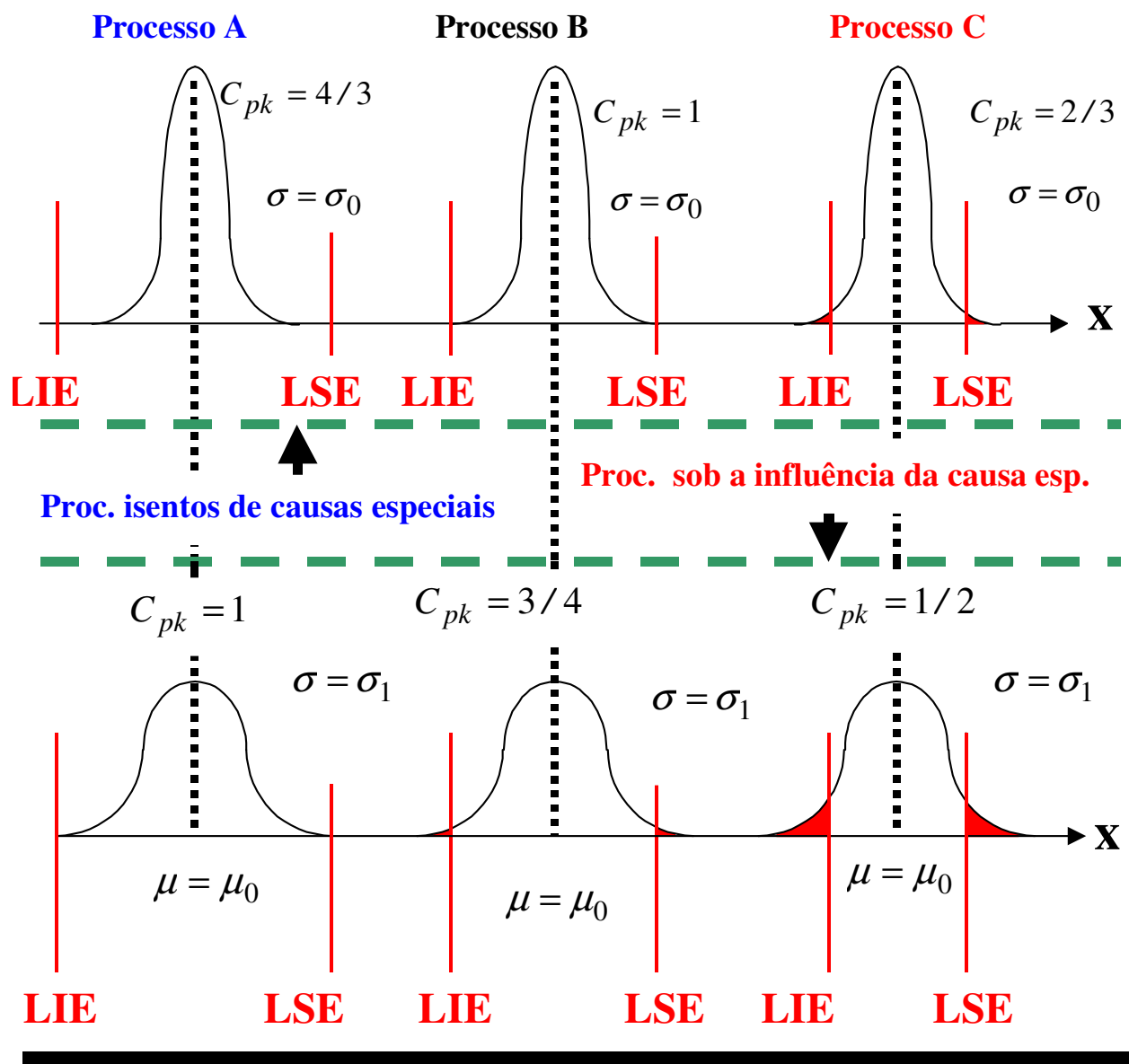
Processo A



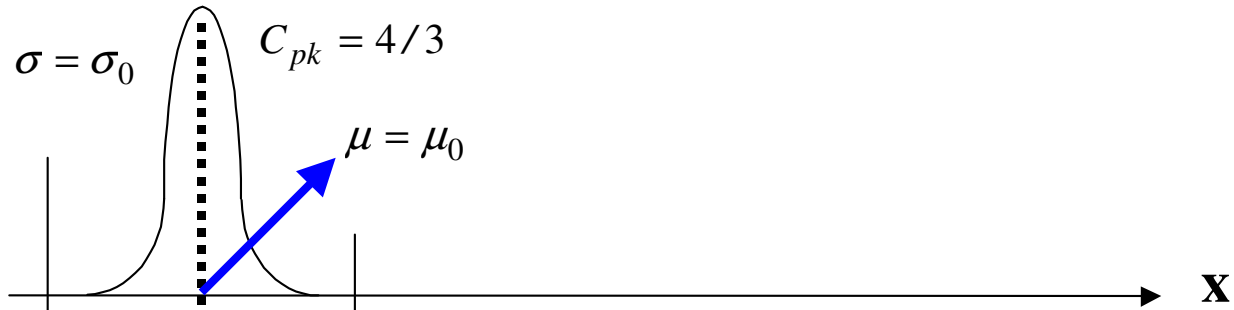
Processo B







Processo A



LIE

LSE

Proc. isentos de causas esp.

Proc. sob a influência da causa esp.

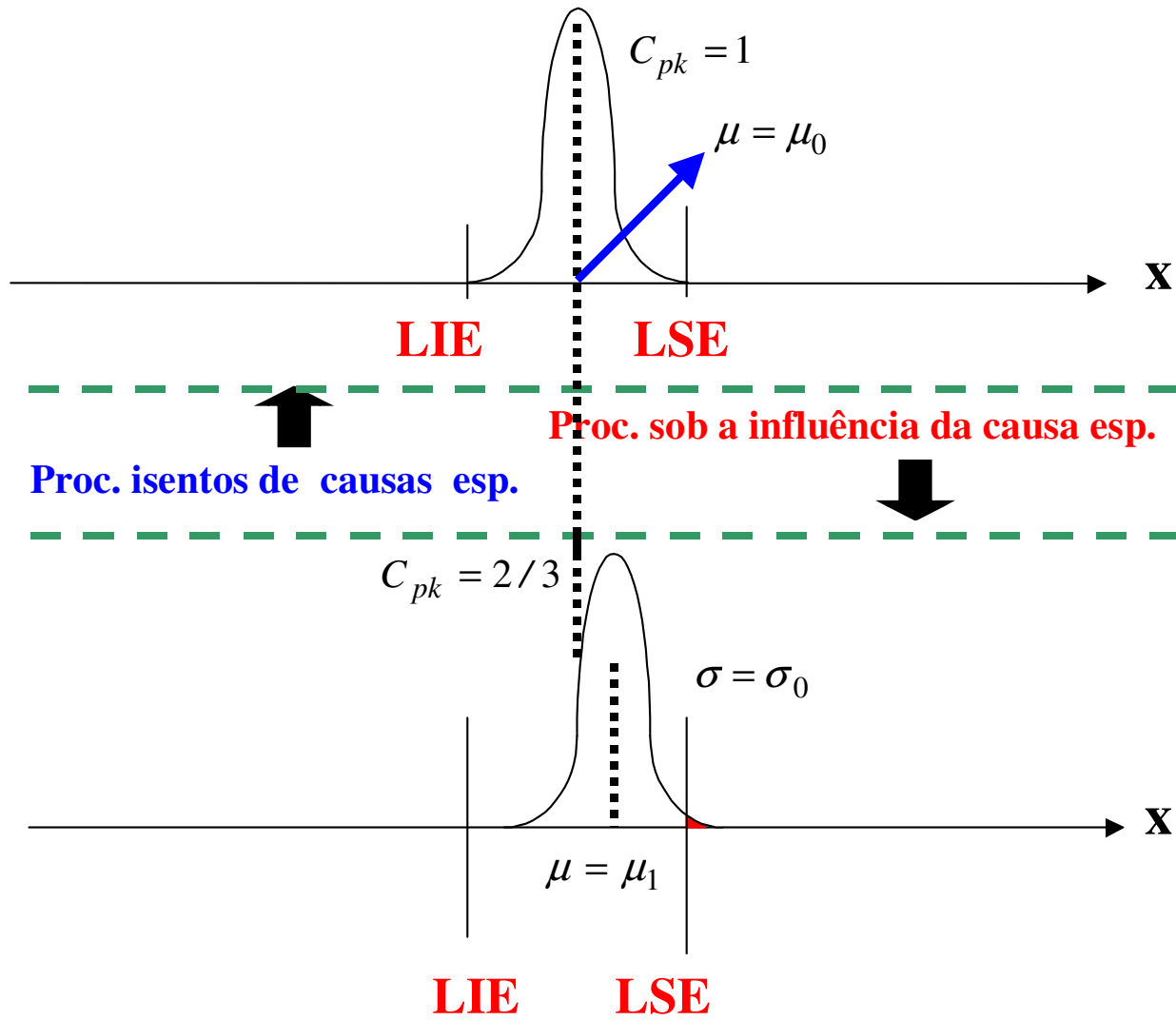


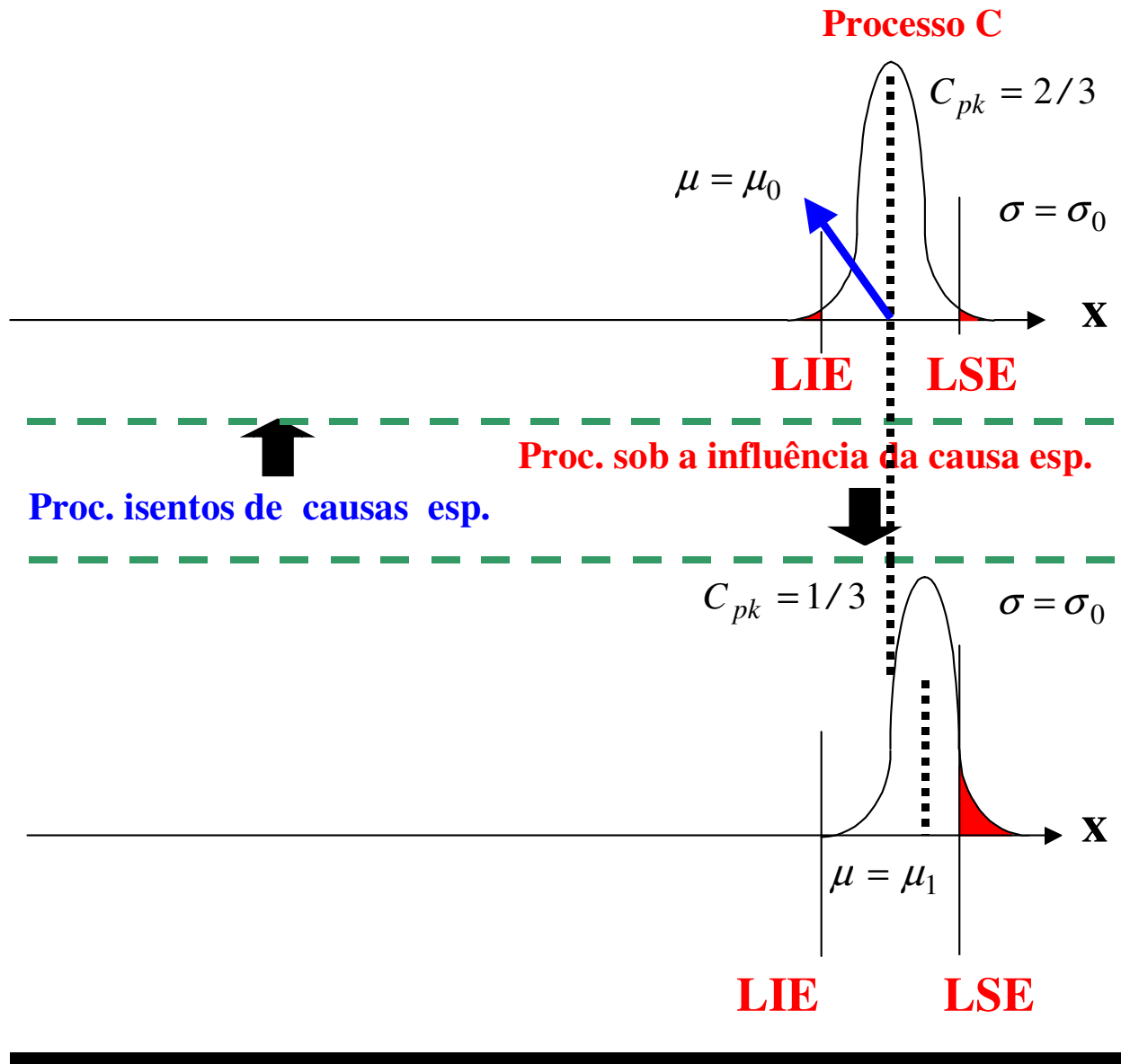
LIE

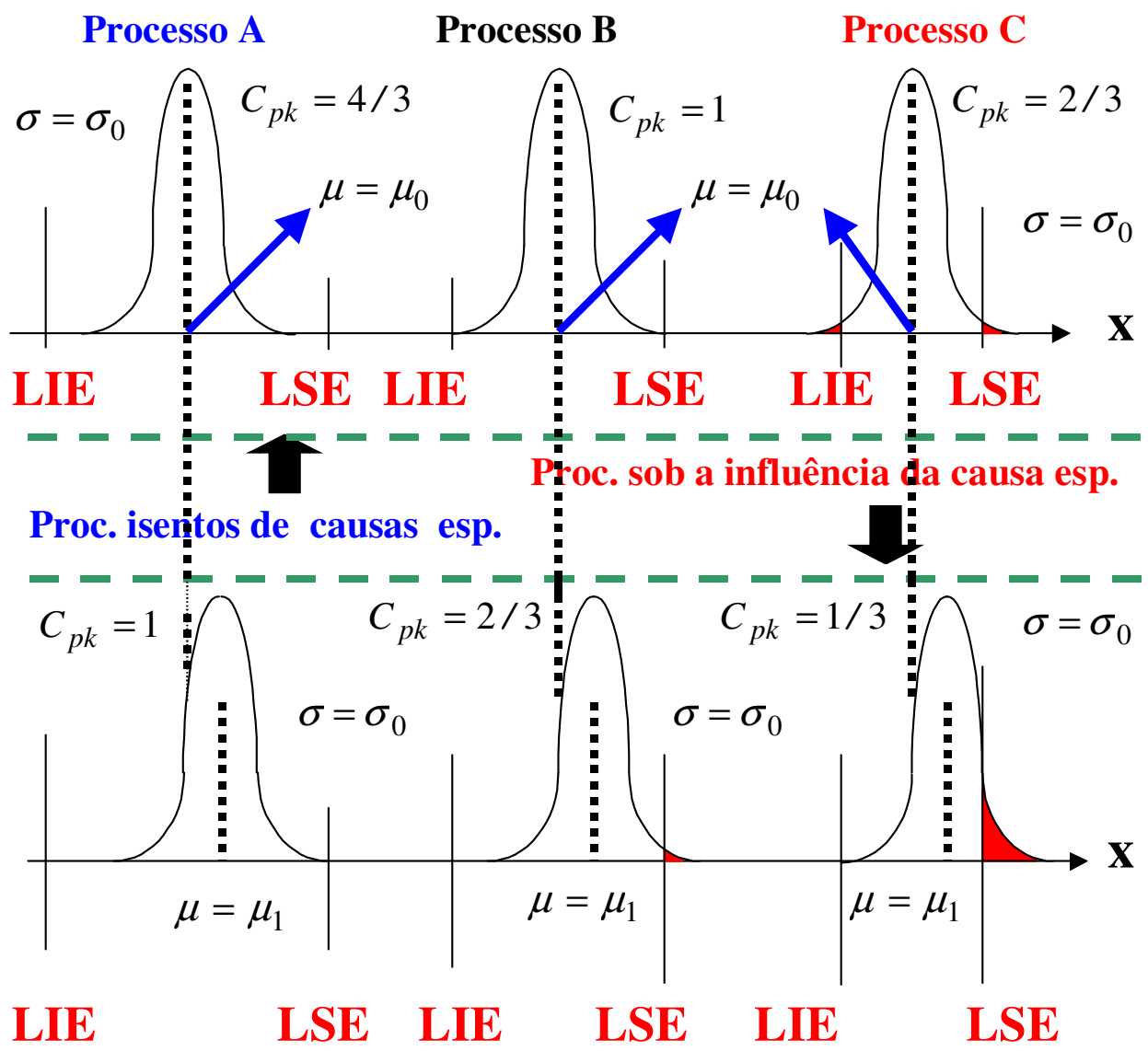
LSE



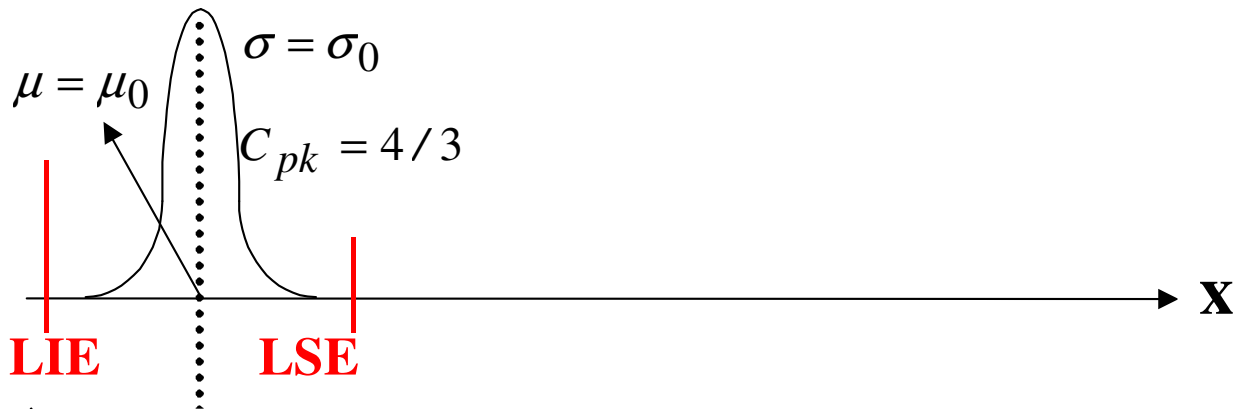
Processo B





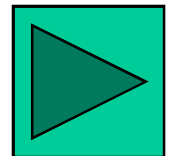
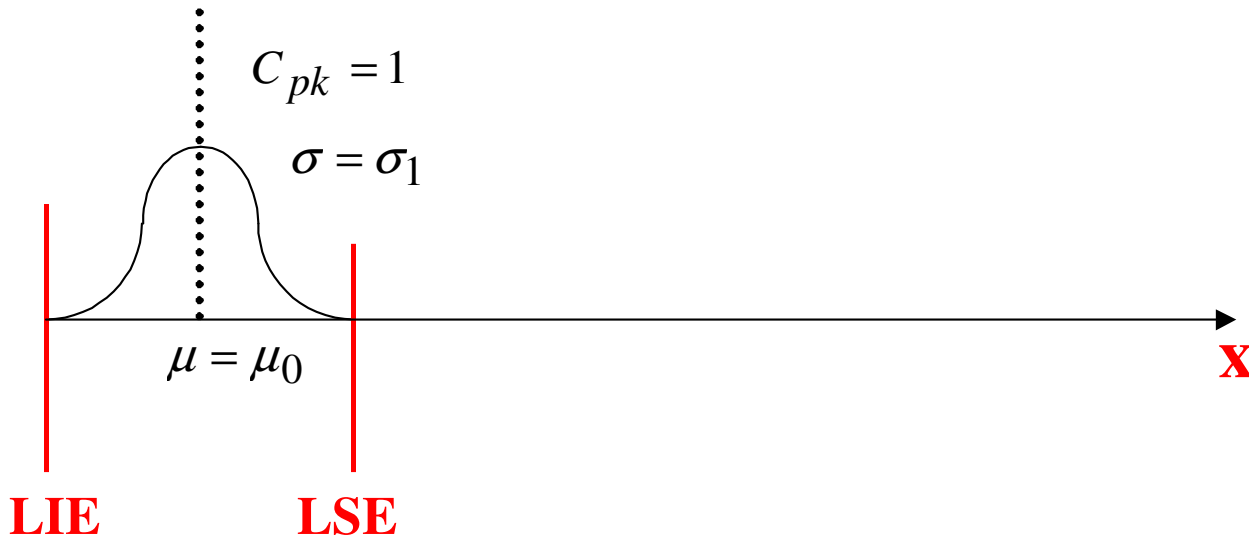


Processo A

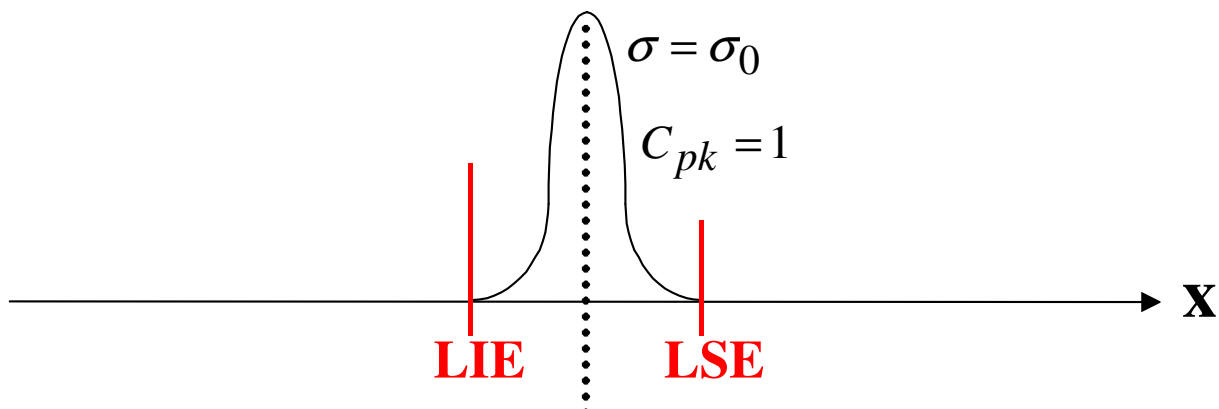


Processos isentos de causas especiais

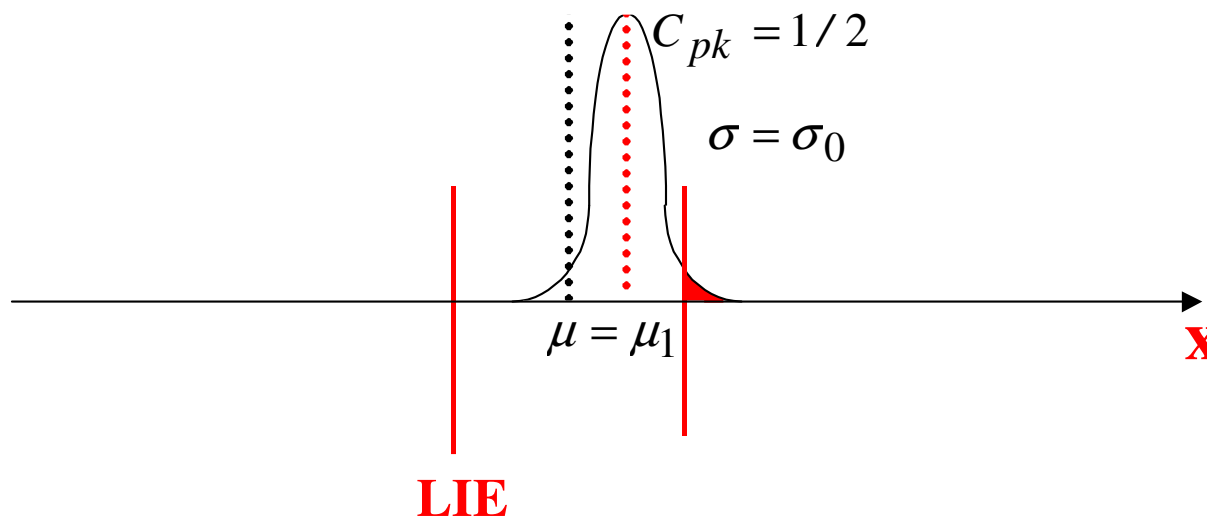
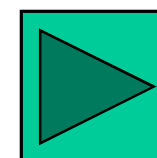
Proc. sob a influência da causa especial



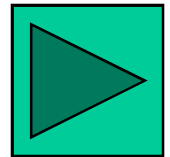
Processo B



Processos isentos de causas especiais $\mu = \mu_0$ Proc. sob a influência da causa especial

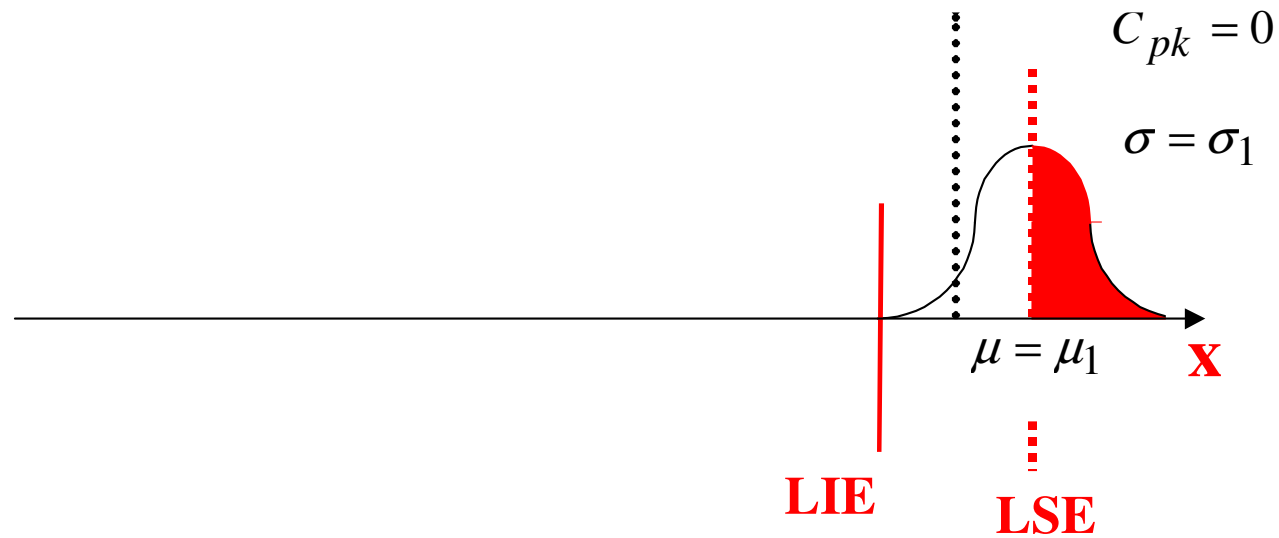


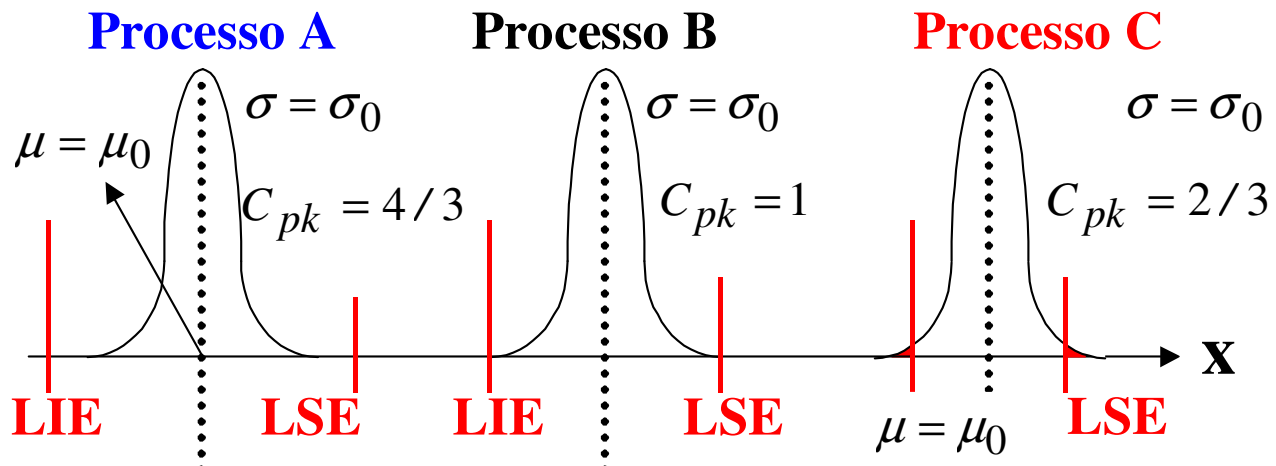
Processo C



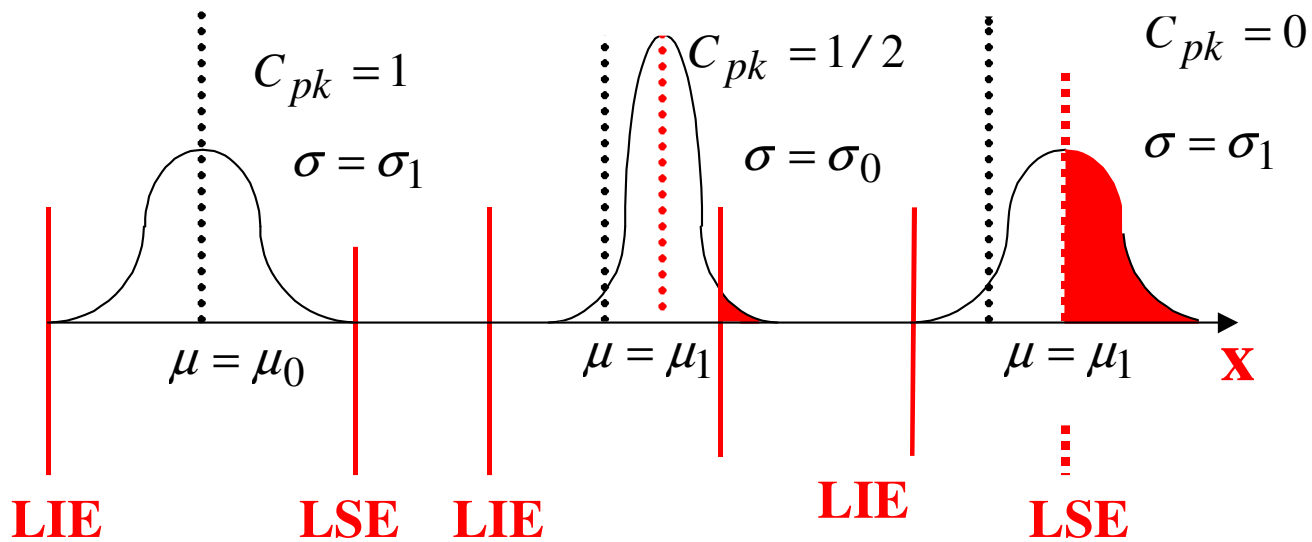
↶ **Processos isentos de causas especiais**

Proc. sob a influência da causa especial ↷



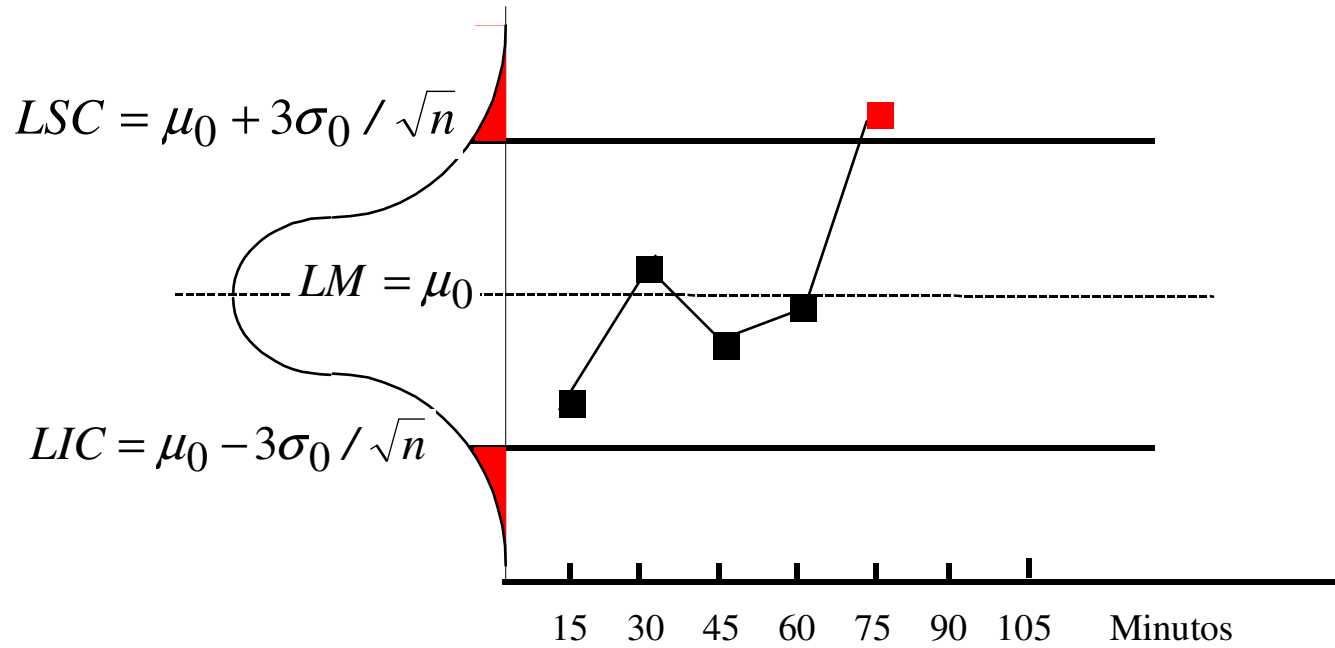
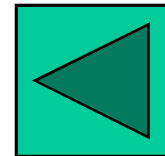


Processos isentos de Proc. sob a influência da causas especiais $\mu = \mu_0$ causa especial



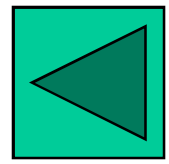
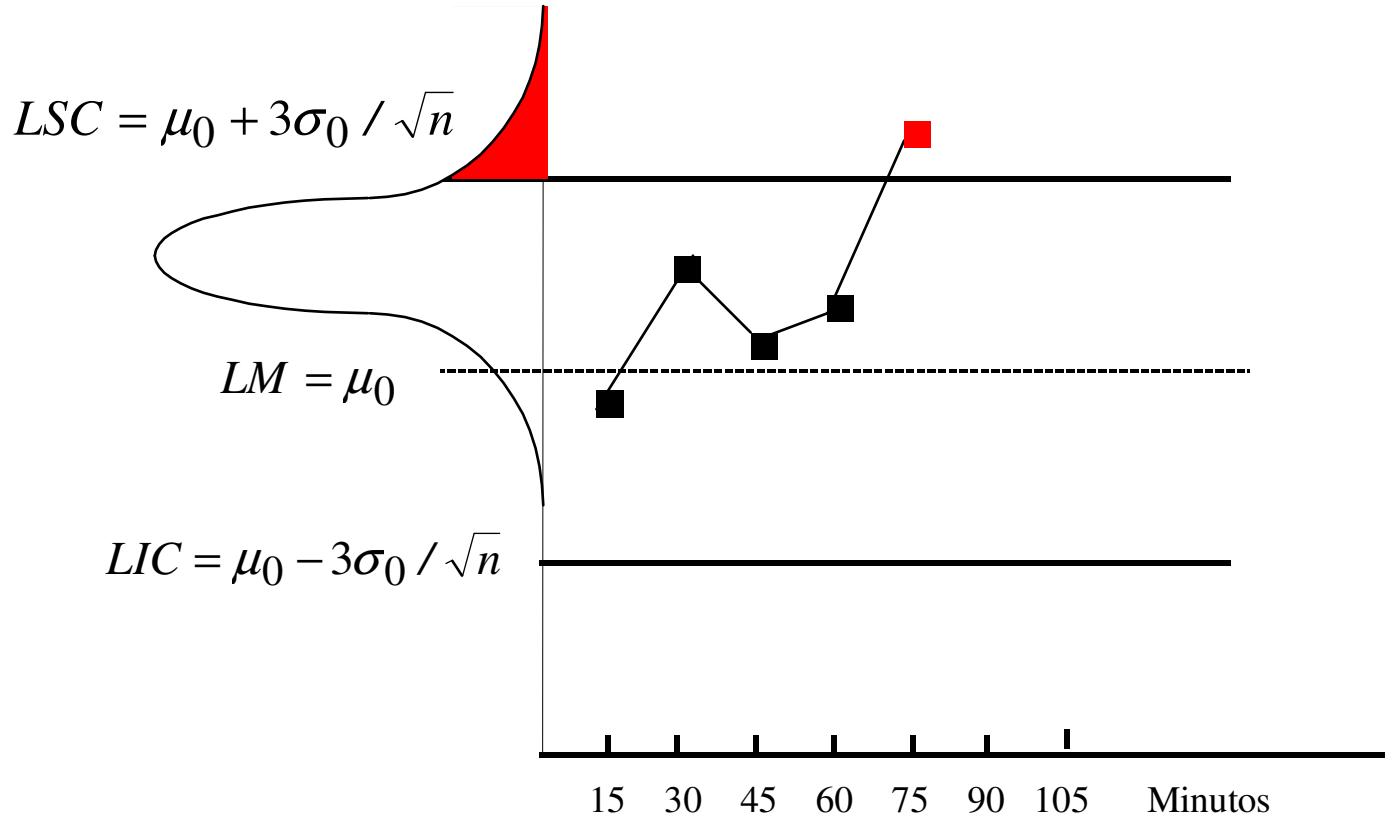
Processo A

$$\bar{X} \sim N(\mu_{\bar{X}}; \sigma_{\bar{X}}) \sim N(\mu_0; \sigma_1 / \sqrt{n})$$



Processo B

$$\bar{X} \sim N(\mu_{\bar{X}}; \sigma_{\bar{X}}) \sim N(\mu_1; \sigma_0 / \sqrt{n})$$



Processo C

$$\bar{X} \sim N(\mu_{\bar{X}}; \sigma_{\bar{X}}) \sim N(\mu_1; \sigma_1 / \sqrt{n})$$

$$LSC = \mu_0 + 3\sigma_0 / \sqrt{n}$$

$$LM = \mu_0$$

$$LIC = \mu_0 - 3\sigma_0 / \sqrt{n}$$

15 30 45 60 75 90 105 Minutos

